Pollution of Stream Waters in Kentucky

By
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Director and State Geologist

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Kentucky Geological Survey

WILLARD ROUSE JILLSON
Director and State Geologist

SERIES VI
PAMPHLET XIV

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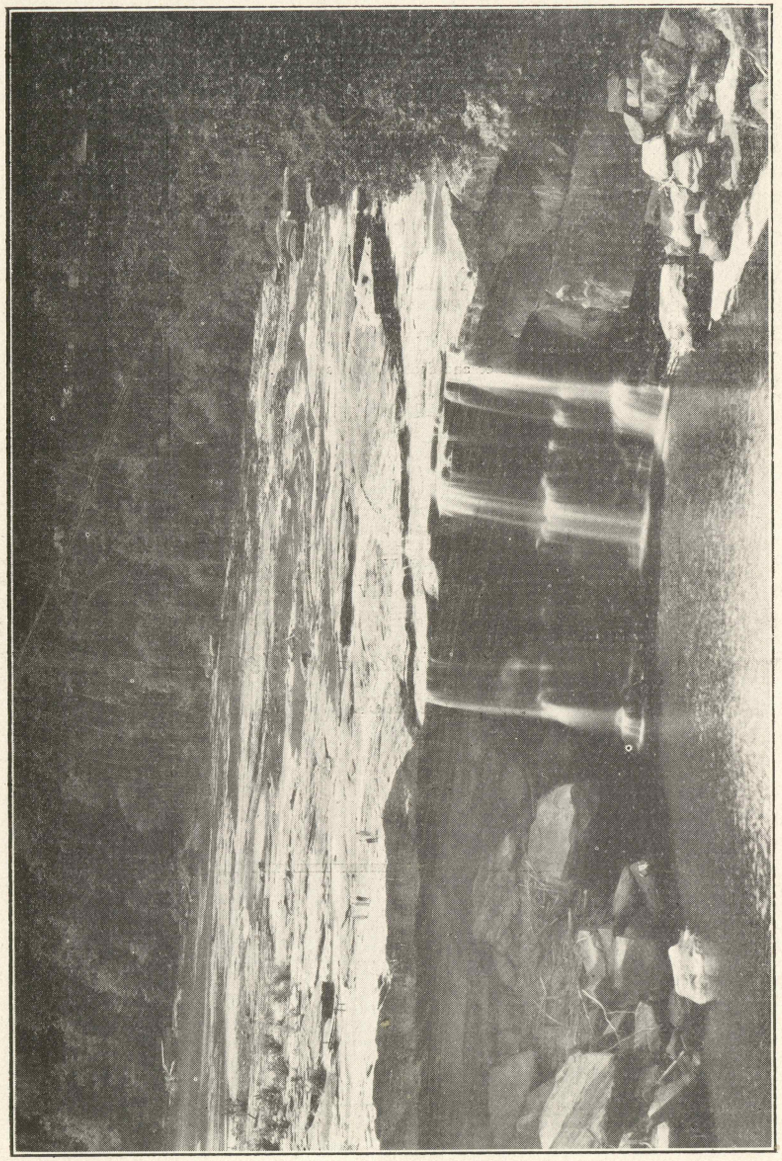

CUMBERLAND FALLS, LOW WATER, SEPTEMBER 9, 1925

This view shows one of the real low water periods of recent years, a time coincident with a high regional pollution. During most of the year the Cumberland River completely fills its channel and at flood sweeps the entire falls' ledge.

POLLUTION OF STREAM WATERS IN KENTUCKY

A Review of General Conditions Involving Fluviatile Contamination . . . Coupled with Some Geological References

By

WILLARD ROUSE JILLSON

Director and State Geologist,
and Member
Kentucky State Park Commission

Eighteen Illustrations and One Index Map of Kentucky Showing Drainage Basins and Regional Pollution

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*Pollution of Stream Waters In Kentucky**

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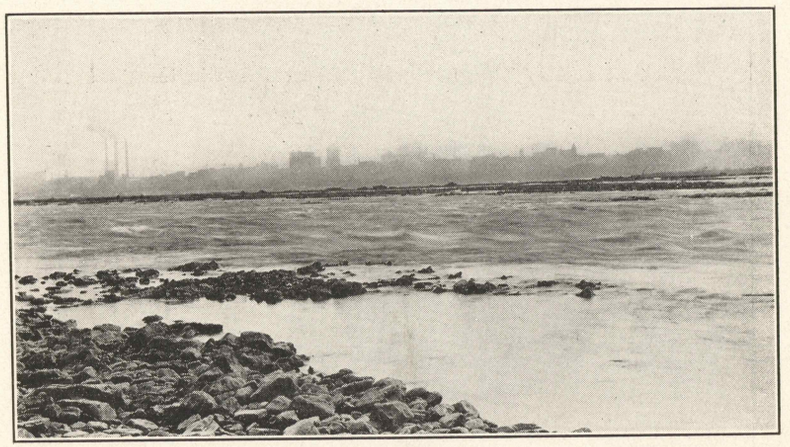
State Geologist of Kentucky

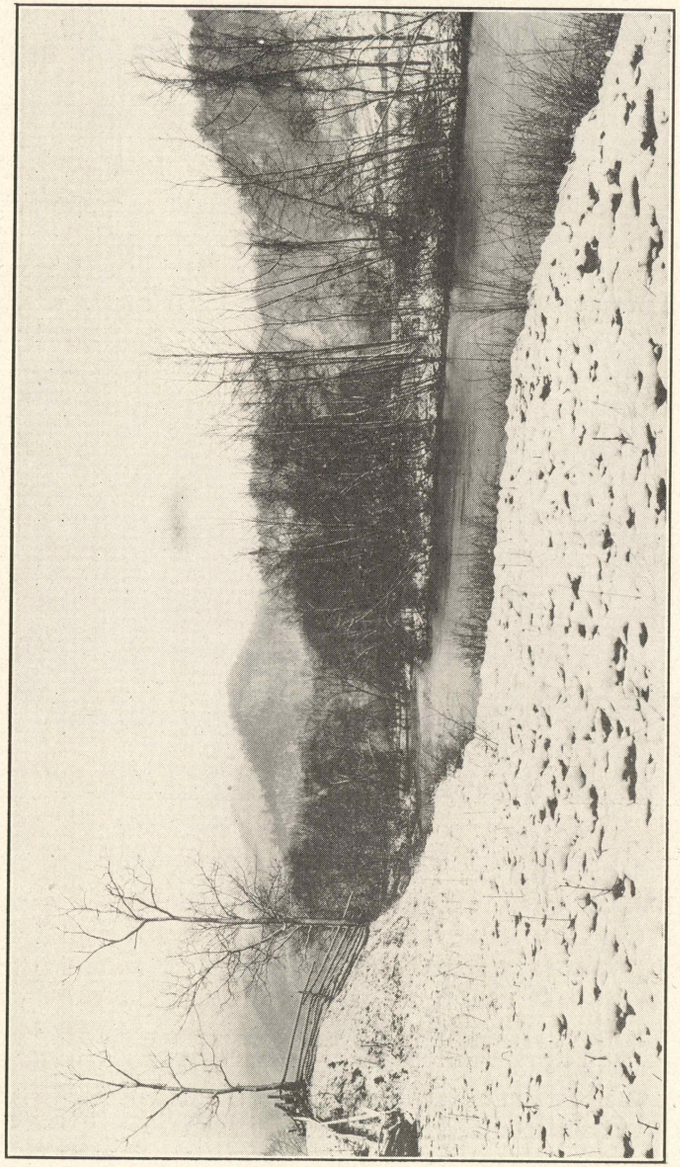
The growing menace of polluted stream waters to the public health, the propagation of fish in our streams, and the perpetuation of ideal natural conditions for bathing and recreational purposes is scarcely realized even by the most vitally affected groups of our citizenship. Only after severe and repeated epidemics or in those instances where industrial operations have killed all the fish in the streams and despoiled the natural beauty of a broad fluvatile region, is it usual for the public to give any concern to this matter. Stream pollution in Kentucky, therefore, presents a very difficult problem, not, however, dissimilar in all vital respects to those found in adjoining states. The problem in Kentucky particularly is so great that it appears to be beyond ideal solution.



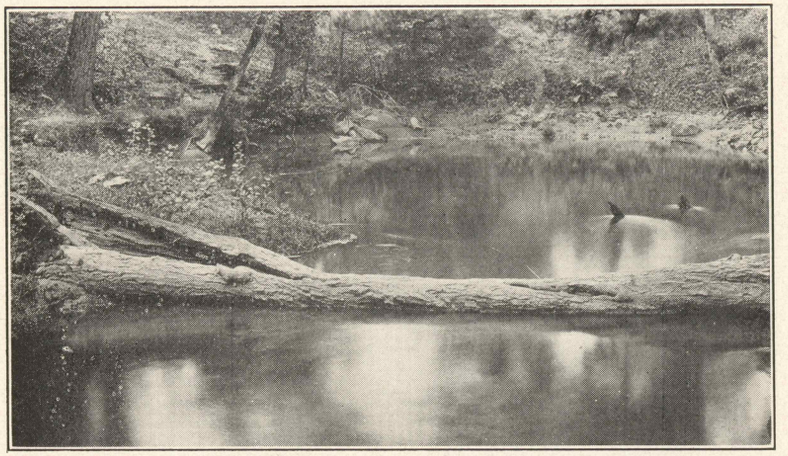
OHIO RIVER, LOUISVILLE IN THE DISTANCE
The increase of pollution in this master stream is alarming.

Those Commonwealths in which industrial and highly centralized populations have developed within the last generation

*Presented before the Isaak Walton League, Lexington, Ky., Jan. 27, 1927.

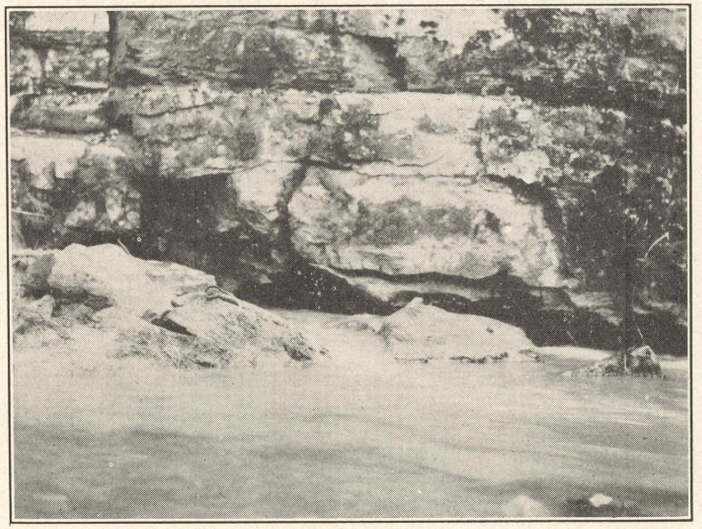


MARTIN'S FORK, CUMBERLAND RIVER NEAR HARLAN, KENTUCKY
A typical mountain stream exhibiting particularly during low water periods a high percentage of pollution, coal mine and domestic drainage and sewage.

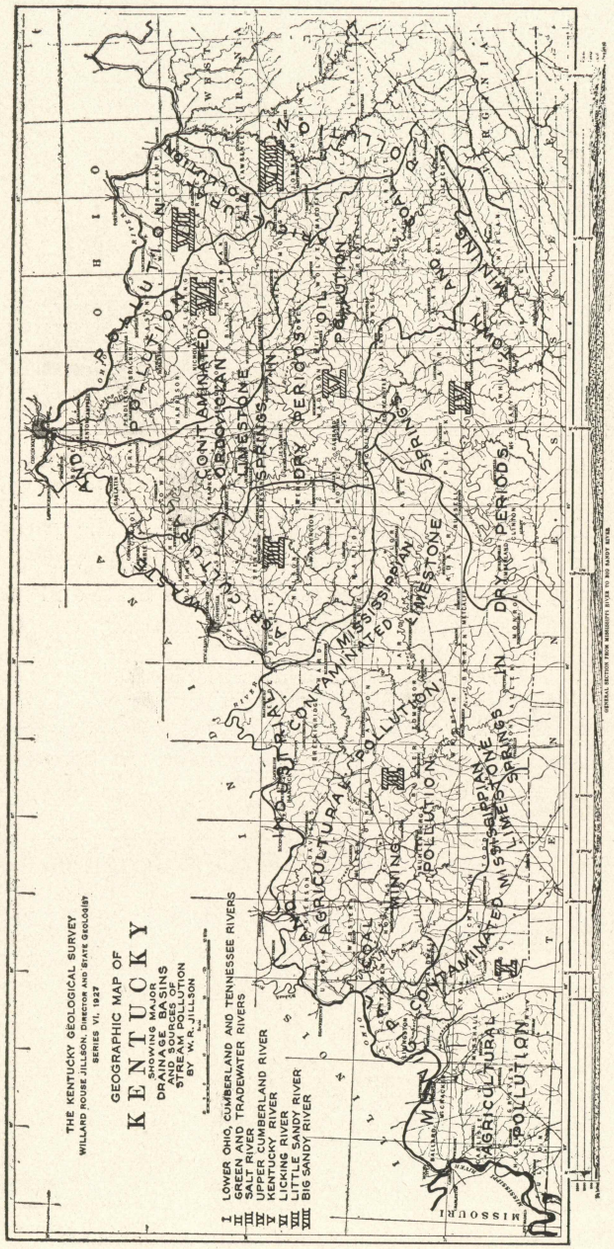


GIANT SPRING PRODUCING LOST RIVER, BOWLING GREEN, KY.
A wonderful spring unfortunately highly polluted.

now find that stream pollution has become one of the greatest of public questions. Such is the case in Pennsylvania where much thought has been given to this problem by the State and municipal boards of health, as well as private sanitary engineering organizations and medical groups. In Pennsylvania it has been

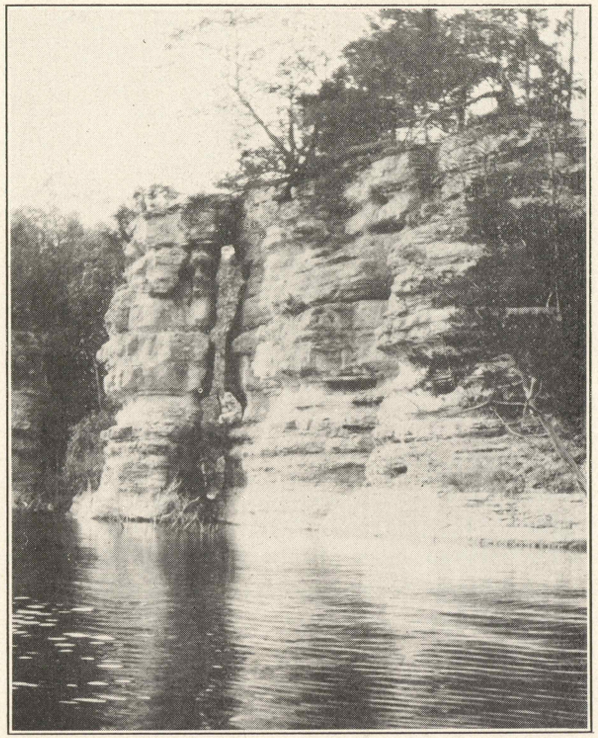


LARGE LIMESTONE SPRING NEAR EDDYVILLE
Many such Lower Carboniferous springs are polluted.



DRAINAGE MAP OF KENTUCKY SHOWING REGIONAL POLLUTION

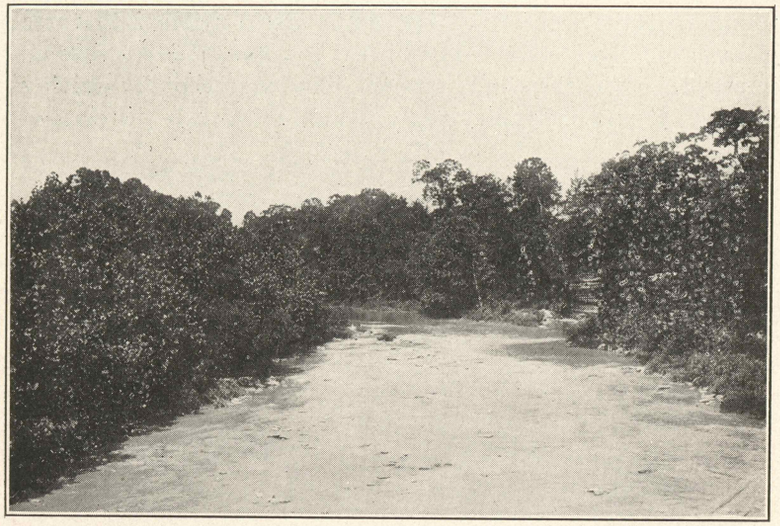
found that the streams of the State are divisible into three classes: (1) those streams in which it is impossible to secure an improvement in the conditions of pollution except by driving out industry now advantageously located there; (2) the class of



CHIMNEY ROCK, DICKS RIVER

The new Herrington Lake behind Dix Dam though frequently crystal clear shows pollution.

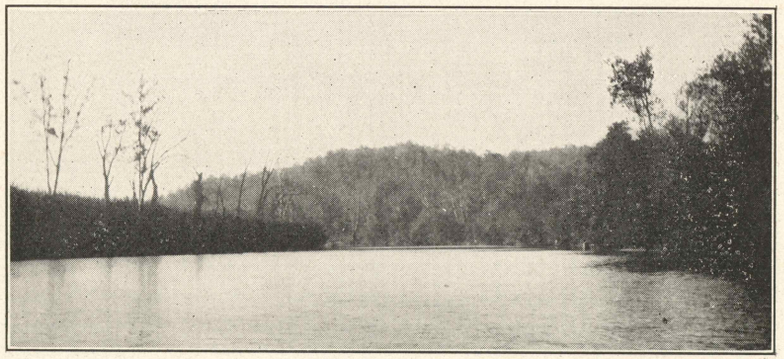
streams which is in effect the largest group of streams in the State in which some improvement can be effected but in which all pollution cannot be eliminated; and (3) a relatively small group of streams, and in effect small streams themselves, which should and can be kept in a state of high purity. Efforts are now being made throughout the Eastern United States in many of the commonwealths to classify the streams according to this division and hold these classifications in effect. Needless to say, however, the problem is one which is



ELKHORN CREEK IN FLOOD NEAR LOVER'S LEAP
Pollution from Lexington and Georgetown discredits this beautiful Bluegrass stream.

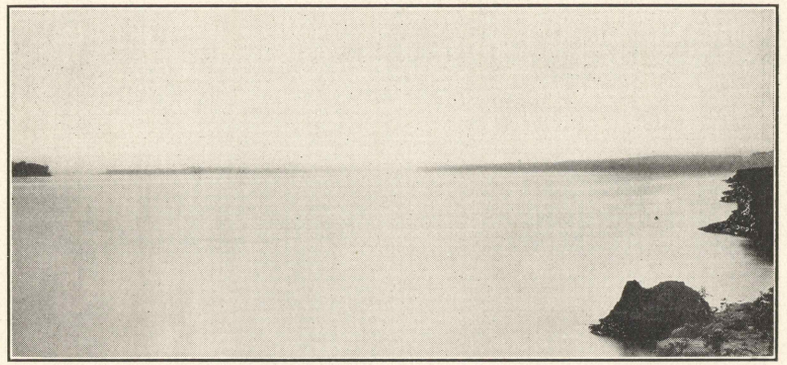
very difficult, and it is doubtful whether it can ever be carried to a theoretically successful conclusion.

In Kentucky the pollution of streams is very great. There are only a few streams in this State which may be considered to be unpolluted, and as elsewhere in the Eastern United States in industrial and mining areas these streams are small. In effect they are really not unpolluted since they carry drainage from



GREEN RIVER AT BROWNSVILLE FERRY
Slight agricultural pollution only occurs in the upper waters of this stream, but urban and coal mining wastes are great throughout its lower course.

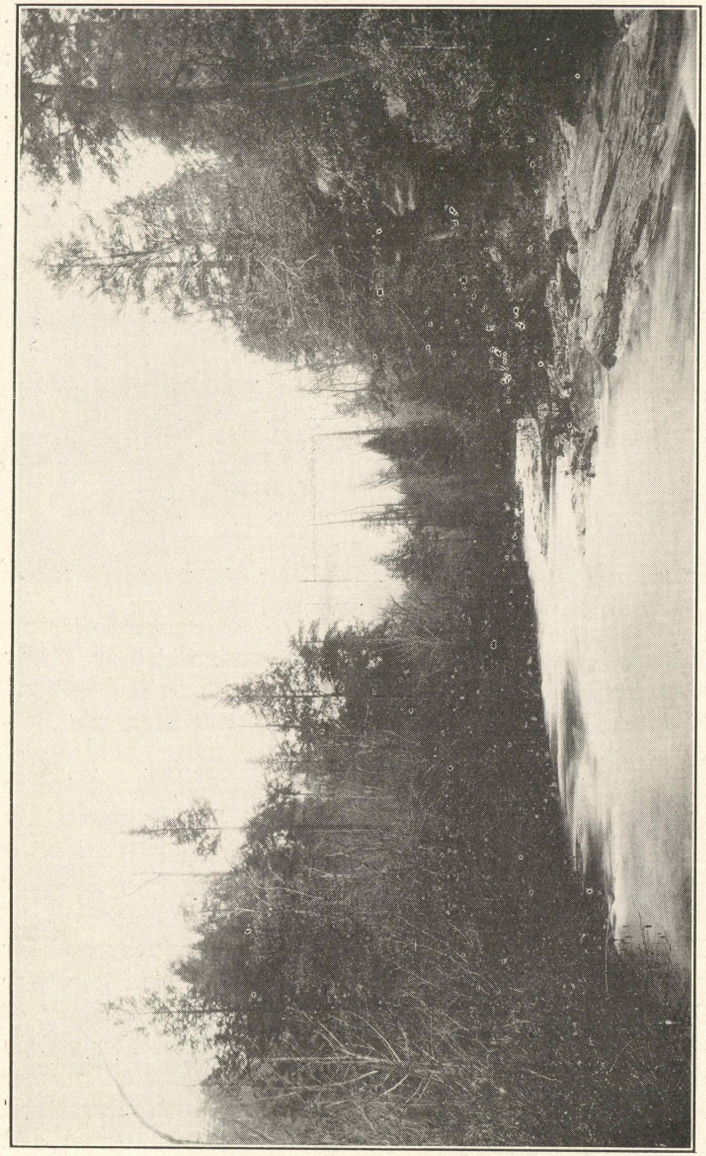
mountain farms, but they are actually the most pure natural waters flowing in the State. Typical of this group of streams are the Upper, Middle and South Forks of the Kentucky River in Leslie and Clay Counties; Martin's Fork in Harlan County; Clover Fork in Letcher County and the Green River in parts of Lincoln County; Upper John's Creek in Pike County; Upper Beaver Creek in Knott County; Jellico Creek in Whitley and McCreary Counties; and Browney's Creek and parts of Clear



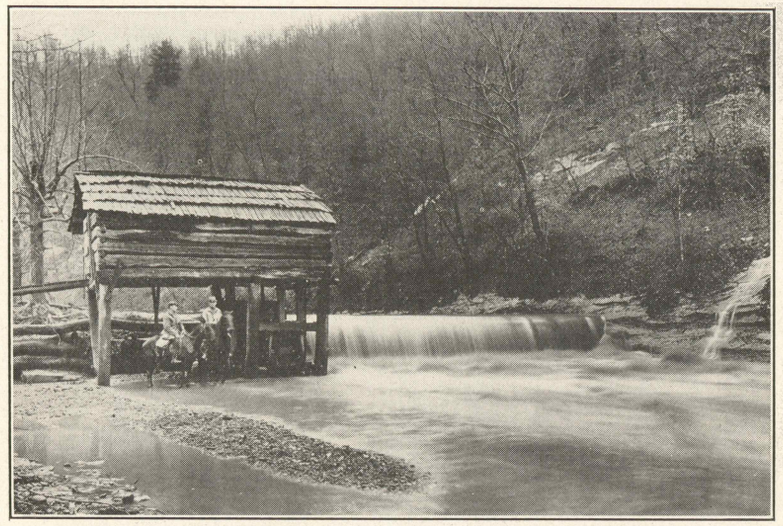
OHIO AND MISSISSIPPI RIVERS, WICKLIFFE

Creek in Bell County. Besides these streams, which are really in a class by themselves, there are hundreds of small creeks and branches in Kentucky which are unpolluted by city, manufacturing, or mining drainage. Individual instances of this sort of stream, which is always restricted in volume and extent, can be found in almost every county of the State. The water, strictly speaking, however, is not entirely unpolluted since the areas are generally used during some portions of the year at least for the grazing of stock.

During the period of the settlement of Kentucky and for many years following, the countless springs of this State were rightly regarded as a source of unpolluted water. Many of the springs were very large, veritable meadow brooks, and in some few instances fair-sized creeks at their point of issuance from the bedded Ordovician and Mississippian limestones. About such springs, especially in the fertile Bluegrass and Pennyroyal farming areas, towns quicklky sprang up using the cold, clear waters so copiously bestowed by nature for drinking



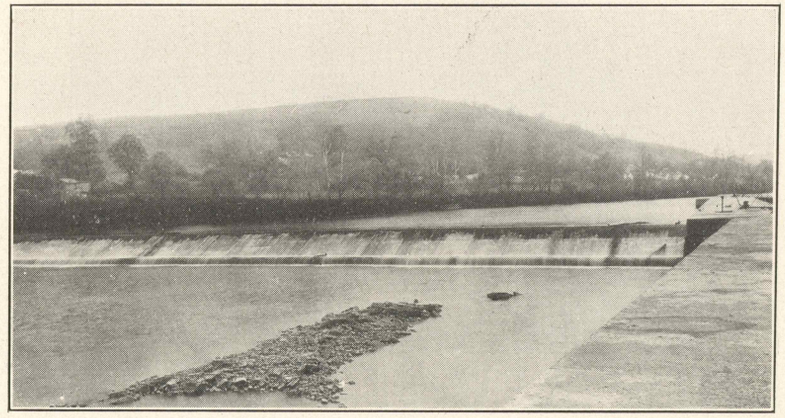
UNPOLLUTED MOUNTAIN STREAM NEAR CUMBERLAND FALLS



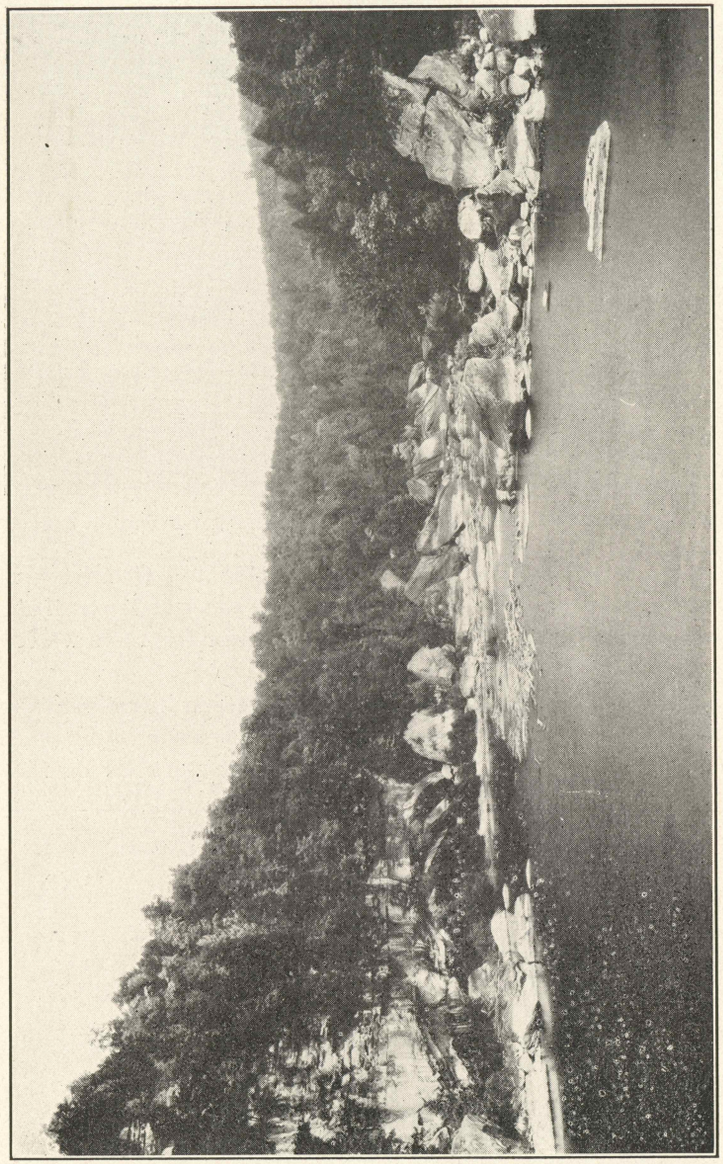
LOG WATER MILL, LONG'S CREEK, BREATHITT COUNTY

as well as other purposes. Lexington, Versailles, Georgetown and many other places could be cited as instances of towns that placed an early dependence upon large springs for their water supply.

It is a fact that is substantiated by scientific investigations of the State Board of Health that in the cavernous limestone regions of Kentucky comprising considerable portions of the



DAM AT LOCK NO. 4, KENTUCKY RIVER, FRANKFORT



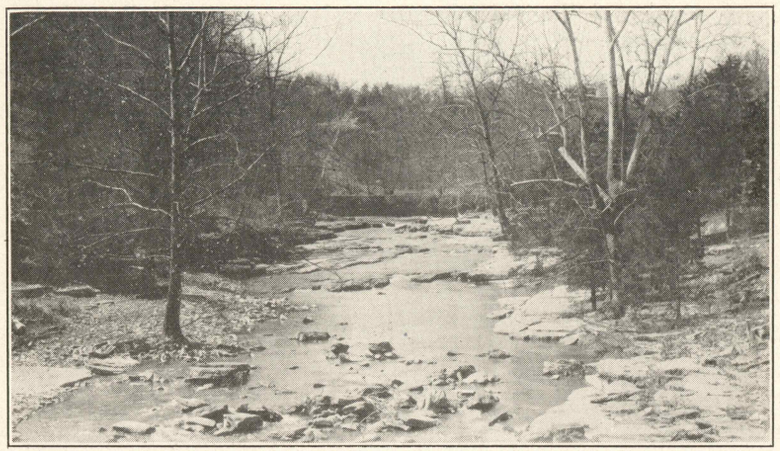
UPPER GORGE OF THE CUMBERLAND RIVER IN LOW WATER

Pennyroyal and Central Blugrass uplands 99% of all springs and small streams fed from springs in part or in whole carry contamination during some portions of the year. The extension of open interconnecting underground channels in some parts of Kentucky is quite beyond calculation. In the Karst region of Southern Kentucky, the city of Bowling Green makes use of natural underground channels in Mississippian Limestones for its entire municipal sewage disposal.

Notable examples of contaminated springs are many, particularly in the elevated Bluegrass region situated on Ordovician Limestones. Chief among these may be cited the case of the city of Versailles where a complete cycle was established by the State Board of Health. Water used for drinking purposes passed through the human body into sewage and back again into the spring water drinking supply. It is with much credit to the town of Versailles that it can now be said that this awful condition has been remedied by the installation of an entirely new and different pure water supply.

While Kentucky's shallow springs are susceptible to much contamination, there are in the State many deep seated and mineral springs such as those at Crab Orchard, Big Bone Lick, Blue Lick and Dawson Springs where the source of supply is isolated from contamination and the waters in many instances in part or in whole are fossil waters or deposition. Any natural water could of course not be more pure than a connate water of deep source.

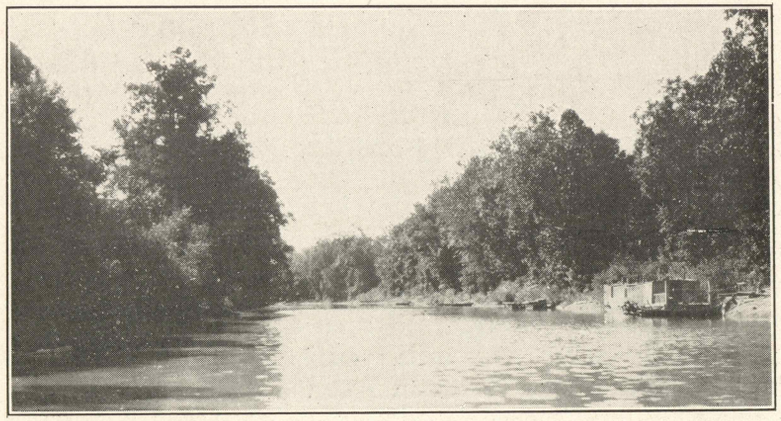
The problem of stream pollution in Kentucky is three-fold: (1) such streams as head in or pass through the Eastern Kentucky Coal Fields and the Western Kentucky Coal Fields are greatly contaminated with coal mine waters, copperas water and other mine acids and oils; (2) streams passing through agricultural areas in Kentucky receive large amounts of waste deposits from creameries and canning factories. This class of wastage is very large and is a very considerable factor in the pollution of streams. With it is to be grouped industrial chemicals and industrial wastages such as those from thermo-chemical plants, factories, etc. A notable example of this class is a tannery polluting Yellow Creek in Bell County. (3) The third group of polluted stream waters are those which find their con-



SMALL STREAM IN THE BLUEGRASS
The View is of Jessamine Creek below the mill dam, 1½ miles from Wilmore, Kentucky.

tamination directly from town, city or mining camp sewage. The area or source of contamination is generally found to be along the upper waters. Chief among these streams are the Tug and Levisa Forks of the Big Sandy River, the North Fork of the Kentucky River, the Main Cumberland, the Tradewater and the Green Rivers.

It is now a well known fact that mining camp sewage is one of the most insidious sources of contamination, especially in dry weather, to be reckoned with in the problem of stream pollu-



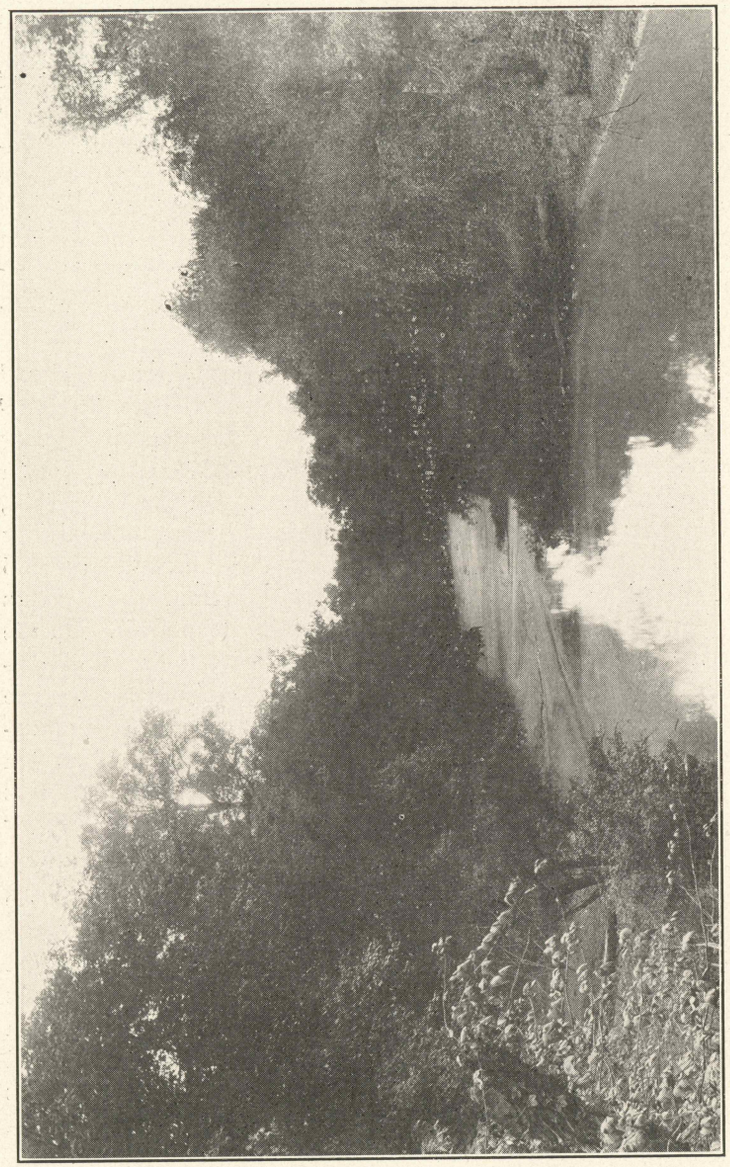
POND RIVER, FROM JEWELL CITY FERRY

tion. Citizens of this State will be surprised to learn that above Harlan there are forty coal mine operations all of which drain into the Cumberland River; above Pineville there are 110; and above Barbourville there are 160. The aggregate amount of sewage dropped into the waters of the main Cumberland River by the coal operations and other mining camps is almost inconceivably large. On the North Fork of the Kentucky River there are 30 mining camps above Whitesburg; 665 above Hazard; 100 above Jackson; and 110 above Beattyville. Again the amount of sewage from the North Fork of the Kentucky River is very great as some of the largest coal operations in the State of Kentucky are in this river valley.

On the Levisa Fork of the Big Sandy River there are 35 coal operations above Pikeville in Kentucky; and 88 above Prestonsburg in Kentucky. There are 35 above Williamson on the Tug Fork of the Big Sandy River in Kentucky, and 40 above Louisa on the Tug Fork of the Big Sandy River. On the two Forks, Levisa and Tug of Sandy, there are counting those in Kentucky as well as those in Virginia and West Virginia well over 225 coal operations, the sewage and mine wastes from which plants all drain into the Big Sandy River and its tributaries. On the Green River there are 50 coal operations above the town of Calhoun, and over 80 in the entire Green River Basin. On the Tradewater River in Western Kentucky there are 60 coal operations, many of them of gigantic size. The amount of stream contamination, therefore, at low water passing such towns as Barbourville, Jackson, Louisa, Calhoun, and Sturgis is very great.

Up until recently so little attention has been given to the problem of contamination of water supply that the public health has been greatly menaced and has been ravaged by repeated epidemics. The more delicately constituted fish of these streams have in a large measure been exterminated. Much has been said about the dynamiters, the seiners, and the "unlawful catch" from our Kentucky streams, but it is probably a fact that more fish and spawn are exterminated annually by contaminated waters in this State than are caught in defiance of the law.

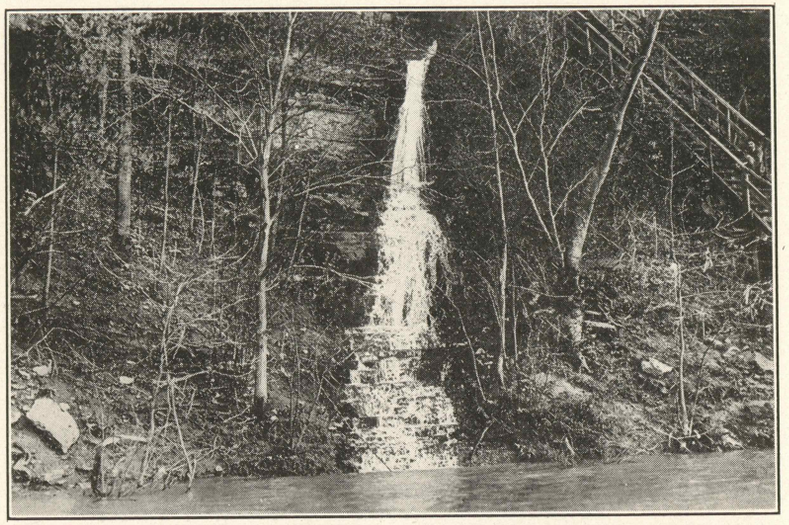
Within recent times small towns in Eastern Kentucky which have formerly used stream waters have been forced to resort to



MAYFIELD CREEK, A SLUGGISH CONTAMINATED STREAM IN JACKSON'S PURCHASE

other sources. Whitesburg, Pineville, Jackson and Beattyville use deep wells; Hazard uses river water purified as does Pikeville. Prestonsburg uses river water with scarcely any purification, and is one of the notably poor supplies of drinking water in the State. Along the Ohio River, Paducah, Henderson, Louisville, Covington, Newport and Ashland have excellent supplies of water derived from the Ohio River and purified, but these towns are confronted by the problem of industrial waste in the Ohio River from the thermo-chemical and gas producing plants. These operations run off considerable quantities of coal by-products into the water. Chief among these are the phenol and the tars which present serious obstacles to purification for drinking purposes by the chlorine process. The chlorine unites with the phenol to produce a chloro-phenol compound accompanied by a very disagreeable taste and odor. Complaints from the public become so vigorous when phenol appears in the water that the chlorine to a considerable extent has to be eliminated in order to make utilization of the water possible in whole or in part for drinking purposes. Such action of course defeats the attempt at purification.

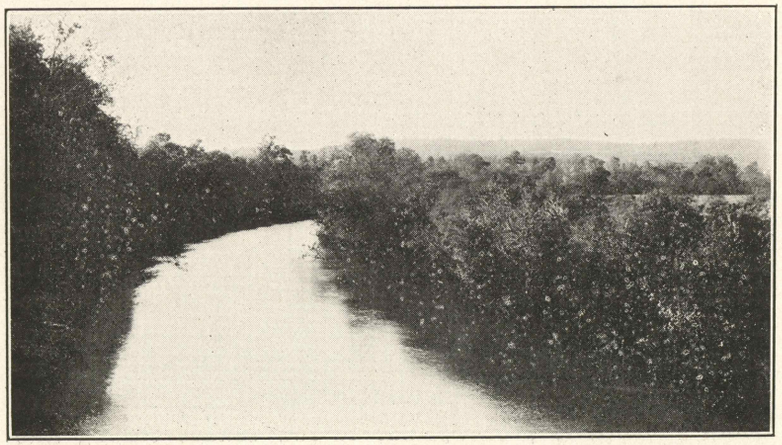
Notable supplies of pure drinking water are found at Middlesboro from Fern lake, Lexington and Richmond from semi-isolated reservoirs thoroughly treated by purification processes, and at Frankfort from the Kentucky River where very modern purification methods are employed. Some of the worst conditions of contamination in drinking water are found in stream water at Prestonsburg, Louisa, and Calhoun, and in many of the small agricultural towns where well water, spring water, and stream water for drinking purposes is derived from limestone rocks. It is not probable that good general health conditions especially in dry periods will ever obtain in Kentucky until small towns generally perfect purification methods for spring, stream and river source drinking water. Neither is it probable that any considerable number of fish will be rejuvenated in our Kentucky streams until some of these sources of contamination, particularly raw sewage, are removed. The recent epidemic resulting in the death of many fish in the waters of South Elkhorn is probably due to raw sewage coming into South Elkhorn Creek from private and public sources in Lexing-



CASCADE IN KENTUCKY RIVER GORGE

The cavernous Ordovician limestones of the Bluegrass region where deeply trenched produce many beautiful "Bridal Veil" falls. Most all of these springs are polluted during low water.

ton above the sewage disposal plant of this city. A similar condition and aggravated one is also to be seen in the waters of North Fork of Elkhorn Creek which receives raw sewage from the city of Georgetown, though in this latter case plans are now



BARREN RIVER, BELOW BOWLING GREEN. A VERY BEAUTIFUL BUT BADLY POLLUTED STREAM

under way to establish a disposal plant and remove this menace to the public health as well as the fish in these small streams, and the use of the waters for bathing purposes.

In conclusion it should be reiterated that although the problem of stream pollution in Kentucky is at the present time one of large proportion and broad extent, it is one which can in part at least be rectified. Cities and small towns should be prohibited by statute from dumping raw sewage into drainage channels. Petroleum pollution from operating oil fields and other sources chiefly municipal should be disallowed. Industrial wastes in many instances could be corrected through proper treatment, particularly that of sedimentation. Inter-State streams such as the Big Sandy, Ohio, Cumberland and Tennessee Rivers should receive Federal sanitary regulation. A greater activity on the part of the Sanitary Division of the State Board of Health should be encouraged by sufficiently increased appropriations to enable this Bureau to make adequate and comprehensive investigations of stream pollution from all sources in Kentucky.

In contrast to these proposals it is only fair to say that any attempt to remove all of the industrial and chemical wastes now finding their way into Kentucky streams will prove to be not only a long and up hill fight, probably never possible of successful and complete solution, but rather result almost immediately in driving industry out of Kentucky and reducing portions of this State to general impoverishment. This would certainly be the case in industrial and mining regions as well as other localities. Such a course of procedure is unthinkable, and any group or groups seriously minded in this undertaking would do well to consider the importance of the continued and expanded prosperity of this Commonwealth on the one hand as contrasted to an ideal no matter how desirable but not entirely necessary on the other.